(284)

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Series Title **AGRICULTURAL MEMORANDUM NO. 1101**

Title **Gridpoint Meteorological Data of Rainfall and Temperature for England and Wales**

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Abstract **Gridpoint data of temperature and rainfall on a 5 km resolution over England and Wales have been developed for the new Agricultural Land Classification Scheme. Other uses of the data are discussed.**

Date: October 1988
Ramp Classification: D1
Keywords: Accumulated Temperature, Maize, Ontario Units, Rainfall

No of pages: 6 No of diagrams 0 No of References 5

1. INTRODUCTION

Towards an objective scheme for assessing the Agricultural Land Classification (ALC) of a site (MAFF 1988), meteorological datasets have been created on a 5 km resolution (Minhinick 1988, Met. Office 1988). This memorandum discusses the potential for using these data for non-ALC investigations; the emphasis will be on the temperature datasets.

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2. THE GRID POINT DATA

Data have been resolved onto a 5 km grid coincident with the 5 km intervals of the Ordnance Survey National Grid, having its false origin near the Isles of Scilly. The sources of these data are discussed by Minhinick (1988) and for methods to obtain sub-grid scale estimates see Met. Office (1988).

At every grid point the following information is available:

a. Height above mean sea level

b. Lapse rate of Average Annual Rainfall

c. AAR - Average annual rainfall (1941-70)

d. ASR - Average summer rainfall (April-September) (1941-70)

e. ATO - Median accumulated air temperature above $0^{o}C$ (January-June) (1961-80)

f. ATS - Median accumulated air temperature above $0^{o}C$ (April-September) (1961-80)

The data are available in the following formats:

a. Published computer listings (Met. Office 1988)

b. LandIS database; a computer based land information system which has been developed jointly by the Ministry of Agriculture, Fisheries and Food (MAFF) and Soil Survey and Land Research Centre (SSLRC). Access to LandIS is via the MAFF (PRIME) computer network. The range of access software is under development.

c. Choroplethic map of individual basic parameters, manipulated parameters or combined parameters can be produced by SSLRC. The range of pixel classes and colours can also be specified by the user.

3. NON-ALC USES OF ATO AND ATS DATASETS

The spatial distribution of accumulated temperatures above various thresholds for a range of periods is a useful tool in agrometeorology. The likely suitable areas for maize growing have been documented by Hough (1978) based on Ontario Heat Units (OHU) - a form of accumulated temperature.

The ATO and ATS datasets are above a fixed threshold of 0°C, and for fixed periods of January to June and April to September respectively. This memorandum summarises the results of using linear regression methods to relate the ATS dataset to different thresholds in the same period and different thresholds in different periods.

Data for the specific threshold and periods being related to the ATS dataset have been calculated for the 94 stations in Complete Agromet Dataset (Field 1983).

4. RELATIONSHIP BETWEEN ATS AND DIFFERENT ACCUMULATED TEMPERATURE THRESHOLD IN THE PERIOD APRIL TO SEPTEMBER

Using the following rotation:

NOR	Northing	(four figures)
EAS	Easting	(four figures)
HT	Height	
ATS	Acc. Temp > 0	for APRIL - SEPTEMBER
FIVE	" " " 5	for APRIL - SEPTEMBER
TEN	" " "10	for APRIL - SEPTEMBER
OHUAS	Ontario Heat Units	for APRIL - SEPTEMBER
OHUA	" " "	for APRIL
OHUO	" " "	for OCTOBER
OHUMO	" " "	for MAY - OCTOBER

	r^2
OHUAS = -1501 + (1.67 * ATS)	93.8%
OHUAS = -1476 + (1.64 * ATS)+(0.0103 * NOR)-(0.00010 EAS)	94.0%
OHUAS = -859 + (1.40 * ATS) +(0.0120 * NOR)-(0.0113 EAS)-(0.424 * HT)	94.5%
FIVE = -740 + (0.936 * ATS)	99.7%
FIVE = -749 + (0.935 * ATS)+(0.00222 * NOR)+(0.000814 EAS)	99.8%
FIVE = -737 + (0.931 * ATS)+(0.00225 * NOR)+(0.000605 * EAS)-(0.0079*HT)	99.8%
TEN = -1061 + (0.743 * ATS)	95.7%
TEN = -1063 + (0.720 * ATS)+(0.0118 * NOR)+(0.00165 * EAS)	97.3%
TEN = -1050 + (0.715 * ATS)+(0.0118 * NOR)+(0.00141 * EAS)-(0.008 * HT)	97.3%

From the ATS datasets, estimates of OHUAS, FIVE and TEN can be obtained directly with r^2 of over 90%. The benefits of using NOR, EAS or HT are small as compared with the inconvenience of having to make point specific calculations.

5. RELATIONSHIPS BETWEEN ATS AND DIFFERENT ACCUMULATED TEMPERATURE THRESHOLD IN DIFFERENT PERIODS

Hough (1978) identified maize growing areas based on OHU's between May and October. Two ways of relating ATS to OHU's from May to October (OHUMO) were tried. Method 1 attempted to relate OHUMO directly to ATS and Method 2 attempted to relate a surrogate OHUMO calculated from OHUAS + (OHUO - OHUA)) to ATS.

The results are as follows:

Method 1

	r2
OHUMO = -1908 + (1.91 * ATS)	98.7%
OHUMO = -1829 + (1.88 * ATS) + (0.00222 * NOR)-(0.00429 * EAS)	98.7%
OHUMO = -1233 + (1.65 * ATS) + (0.00392 * NOR)-(0.0151 * EAS)+(0.409 * HT)	99.1%

Method 2

	r^2
OHUMO = -1579 + (1.77 * ATS)	93.7%
OHUMO = -1435 + (1.71 * ATS) + (0.00410 * NOR)-(0.00781 * EAS)	93.8%
OHUMO = -598 + (1.39 * ATS) + (0.00649 * NOR)-(0.0230 * EAS)-(0.576 * HT)	94.7%

6. SUMMARY

To directly relate ATS to other accumulated temperatures the following equations are recommended:

OHUAS = -1501 + (1.67 * ATS)
FIVE = -740 + (0.936 * ATS)
TEN = -1061 + (0.743 * ATS)
OHUMO = -1908 + (1.91 * ATS)

Thus the important OHUMO limits for maize growing suggested by Hough (1978) can be equated to ATS as follows:

OHUMO	ATS
2100	2098
2300	2203
2500	2308
2700	2412

using Hough's figures for standard deviation of OHU's (208 OHU's) the required thresholds of temperature to reach limits 9 years out of 10 are as follows:

OHUMO LIMIT (9 YEARS OUT OF 10)	OHUMO (MEAN VALUE)	ATS
2100	2368	2239
2300	2568	2343
2500	2768	2448
2700	2968	2553

Choroplethic maps of ATS have already been produced and therefore areas of particular values of Ontario Heat Units or accumulated temperatures

for different thresholds, can be identified from these maps as long as the time period is similar.

Similar regressions could be produced for the winter period or first half of the year using the ATO dataset. Further use of the rainfall datasets has not been considered.

References

Field, M (1983) Creating the 'Complete Agromet Dataset' Agricultural Memorandum No 983. Meteorological Office Library.

Hough, M N (1978) Mapping areas of Britain suitable for maize on the basis of Ontario Heat Units. ADAS Quarterly Review (1978). 31, pp 217-221

MAFF (1988) Agricultural Land Classification of England and Wales. MAFF (Publications), Alnwick, Northumberland.

Met. Office (1988) Climatological Data for Agricultural Land Classification (in press).

Minhinick, J. H (1988) Agricultural Land Classification Scheme 1988 - climatic aspect. Agricultural Memorandum No 1097. Meteorological Office Library.